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DIGITAL MAPPING OF BLAKENEY POINT, NORTH NORFOLK

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ABSTRACT

This second paper in a short series again presents an up-to-date digital map of a classic British coastal landform, Blakeney Point in north Norfolk, and argues for the wider use of readily available, PC-based graphics software in geomorphological cartography. © 1997 John Wiley & Sons, Ltd.

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INTRODUCTION

Since the beginning of surveying and mapping science, the conventional graphic map has been, and usually still is, the final medium of presentation. Many users will continue to feel more comfortable with a paper map or judge that alternative media do not fit their practical requirements; this applies not just to public and commercial applications, but in field science too, including geomorphology. However, the technology and the ethos are changing and in the future there will inevitably be an increasing use of maps that are supplied, in the first instance, in digital form. Even if a paper map is ultimately most practical, there is no reason why it should not be produced and made available through a process which employs current personal computer technology. In a previous paper (Collin, 1996), the author sought to outline the way in which the mapping process is evolving and the reasons why the digital medium is gaining increasing credence and use, by presenting a large-scale geomorphological map of Hurst Castle Spit in Hampshire. The present shorter paper develops some of the points made then, through a similar map of Blakeney Point in north Norfolk. The aim is at once to provide a digital map of value to the geomorphological community at all levels, and to reinforce the inherent flexibility and ease of application of the digital medium.

After a brief comment on the landform involved, an outline of the computer process will be described, with the intention of making it clear that this is a procedure that can readily be adopted by other landform scientists. Only essential elements of guidance on the use of the map are supplied, as it is presumed that the reader will have access to the previous paper for background purposes.

THE LANDFORM: BLAKENEY POINT

Blakeney Point, in north Norfolk (Figure 1), is undeniably one of the classic coastal landforms of the UK, and in fact is amongst the best known and most visited geomorphological features anywhere. Studies from the early part of the present century at the Blakeney Research Station (Oliver and Salisbury, 1913; Carey and Oliver, 1918) laid the basis of a continuing fascination with this ever-developing sedimentary landform. J. A. Steers began his field investigations here in the 1920s and maintained an interest in Blakeney throughout his career (e.g. Steers, 1927, 1964, 1989). Other notables such as E. C. F. Bird (Bird and Wain, 1963) and C. Kidson (1961) have weighed in at various times, but Hardy's lengthy analysis (1964) is a key paper. Given the record of rapid morphological change in the shingle spit, surprisingly little has been published in recent years, though a few papers can be found (White, 1979; Barfoot and Tucker, 1980) and the National Trust, the owners of the site, have

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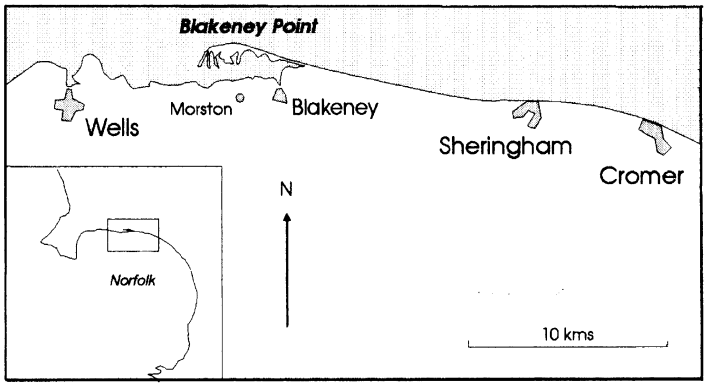

Figure 1. Blakeney Point: general location

Figure 2. Typically large washover aprons in the vicinity of The Hood, Blakeney Point, January 1997

produced a number of publications, including two reports with geomorphological content (National Trust, 1982; Allison and Morley, 1989). Rather more attention has been focused on the associated Morston Salt Marshes and their ecology, an admirable summary being found in Pye (1992).

Despite seemingly full academic consideration, Blakeney has been surprisingly under-mapped. Several university groups or individuals have monitored or remapped the most mobile extremities of the spit: Armour and Lee's 1946 map in Steers (1964) and Bird and Wain's 1961 revision are small-scale, but useful. However, no comprehensive overall map has existed beyond the standard topographic sheets of the Ordnance Survey. Though these are important, showing outline changes on an average 20–30 year interval since about 1880, the Ordnance Survey specification is severely limited for geomorphological purposes. Blakeney Point is a rich landform with a diverse range of shingle (Figure 2), dune, saltmarsh and tidal channel features, covering an area of about 15 km^2, and requires a dedicated geomorphological map to do it justice.

THE 1996 SURVEY

The basis of the digital map is a 1:5000 scale photogrammetric survey utilizing aerial photography flown at low tide on 11 October 1996 (Figure 3). Actually a much larger mapping exercise than Hurst Castle, 38 stereo overlaps were involved, ground control having been surveyed by the author in January 1997. Details of the comprehensive geomorphological specification are unnecessary here, since they are evident on the map itself;

Figure 3. Reduced-scale air photo of part of the most recent developments in the morphology of the western tip of Blakeney Point. Old Far Point right and the present New Far Point left. October 1996 (copyright of Environment Agency, Anglian Region)

this accords with the stated aims for the series of maps (Collin, 1996). Mean High and Low Water Marks are included; these were computed from Admiralty Tide Tables in the approved manner.

DIGITAL CARTOGRAPHY USING POPULAR PC SOFTWARE

The contrast between this particular method of producing a digital map and the commercial digital mapping process was explored in the previous paper. In this simplified methodology no specialist hardware or software is utilized. The origin of the graphic map is naturally significant, but this is assumed; it could be directly derived from available sources (if they exist), or it could be a revised and upgraded topographic sheet or an original survey, as in this instance. The flexibility of the process being promoted lies in the way in which the graphic map can be converted into a computer-compatible digital form, utilizing low-cost, commonly available graphics software.

The following stages are involved, in general and for this specific product:

1. *Original graphic survey*. For Blakeney, 38 small 1:5000 scale graphic plots, none larger than A4 size, categories of map information and landforms being colour-coded.
2. *Scanning*. Each individual graphic plot raster scanned at 600 dpi, utilizing an Epson GT8000 colour scanner.
3. *Vector drawing*. Each scan imported into Adobe Illustrator software on a Mackintosh LC475. The scan forms a raster 'layer' in the image file on top of which all linework is hand 'traced' on screen to produce a vector graphic image, each basic category of information (water features, heights, landforms, vegetation,

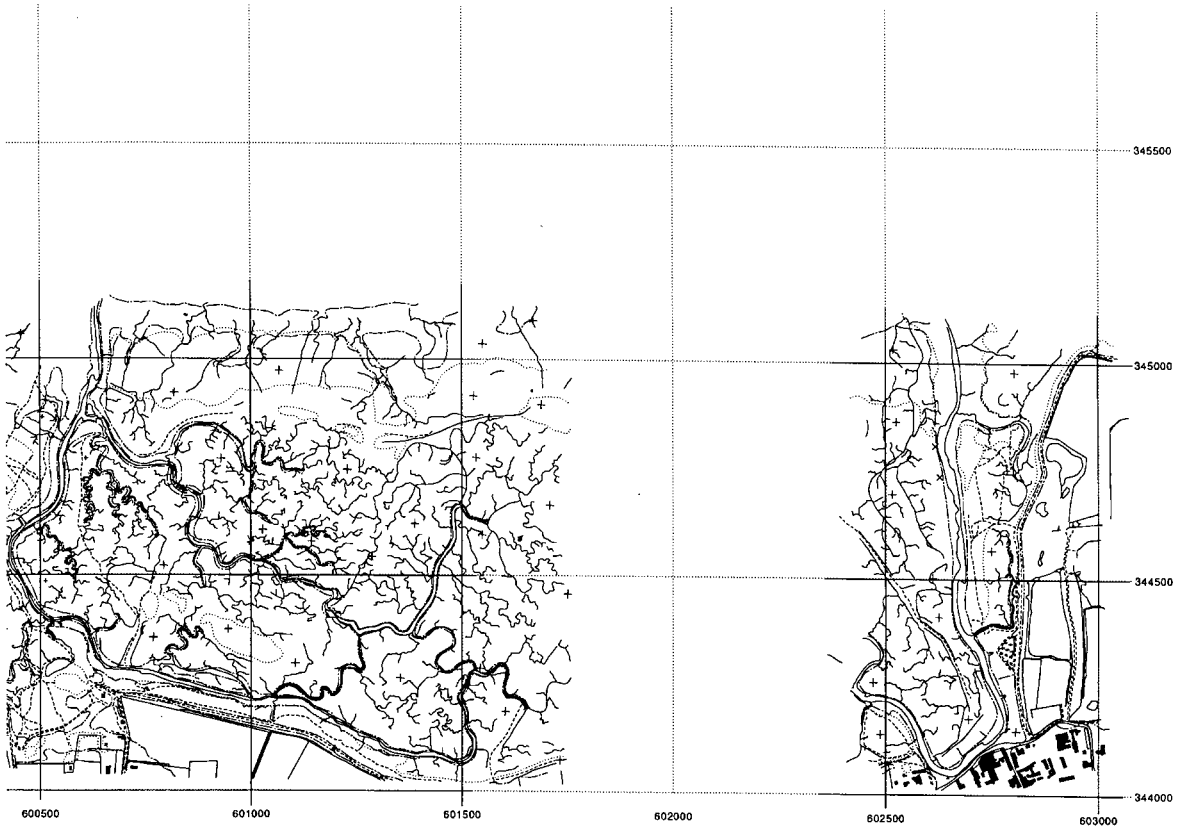

Figure 4. Section of 1:5000 scale grid with four traced photogrammetric plots attached and adjusted. Reduced-scale black and white copy of coloured original in the environs of Morston Marsh and Blakeney

etc.) being constructed on a separate 'layer' with a distinct colour. Lest it be thought otherwise, this is the part of the process that takes the most time and patience and repays experience.

4. *Assembly of the overall map*. A framework for the complete map is created on a new layer within Illustrator as a 500 m grid at 1:5000 scale (10·00 cm squares), over which each traced vector plot is then carefully positioned. Though the original photogrammetic plots may be dimensionally correct, any small format scanner almost certainly introduces some limited degree of distortion, though this is probably unique to that individual device. The process of compilation involves numerically adjusting the individual vector plots to the overall grid (Figure 4); residual distortions are accommodated by minor angular and scale adjustments in the two principal directions. To put this stage of the cartographic operations in context, a detailed assessment of a number of the vector plots in this map reveals that the skewing is typically of the order of 0·06° in the along-scan direction only. The linear dimensions of the grids in the vector traces average 10·07 cm in the across-scan direction (west–east) and 10·01 cm in the along-scan direction (north–south). The skewing is negligible; given that the weights of the grid and detail lines in the original plot are in the range 0·02–0·05 cm, before adjustment only the across-scan error of 0·07 cm is perceptible.
5. *Editing of the map*. Slight overlaps or gaps between continuous details in the individual vector plots are reconciled, after which comprehensive line weight, colouring, fill and lettering options within Adobe Illustrator assist the final presentation of the map.
6. *Export of the image file*. At the end of stage 4, the Blakeney map comprises a 2·0 Mb image file in Illustrator (.ai) format, suitable for Mackintosh users. If exported into the more widely available Coreldraw! software on a PC (.cdr), this converts to a 1·5 Mb image file, with a few minor adjustments to the image then being necessary at this stage. (Since the previous paper, though Coreldraw! has advanced to a relatively expensive Version 7.0, the core vector drawing software, Version 3.0, has reduced in price further to £29 – exceptional

value for the market leader in this type of graphics software.) For the purposes of final delivery to the reader, the image file is then subject to compression to fit it to the 1·44 Mb floppy disk; when unloaded into Coreldraw! the software automatically decompresses the file. The use of a CD-R for file delivery, rather than a floppy disk, was considered, and is technically quite feasible, but the cost and significant under-utilization of the medium caused this option to be rejected.

USE OF THE IMAGE FILE

For the benefit of readers who may not have access to the previous (Hurst Castle) paper, it is felt desirable to outline how the map image file may be utilized.

1. *Opening the file*. Assuming that the graphics package being employed is Coreldraw! on a PC platform, the image file (Blakeney.cdr) can be opened directly, after the decompression procedure is completed. The file is actually delivered as 'Blakeney.EXE', a self-extracting WINZIP file for Windows 3.1 (or 95), which must be decompressed into the user's chosen directory (or folder) on the C: drive of the PC. Though produced in Coreldraw! Version 3.0, no difficulty should be experienced in importing the file into all subsequent versions. For Macintosh users an Illustrator version (Blakeney.ai) is available from the author on request.
2. *Viewing the image*. Once opened in Coreldraw! or imported into whatever other compatible graphics software might be used, the map image may then be readily viewed at any scale. The fine resolution of the vector image becomes apparent if a high level of zoom is applied. In viewing and otherwise manipulating the image, the specification of the PC will be important. Significant changes in the last 12 months are that the PCs have commonly attained much more powerful processors, faster cache, larger amounts of RAM and better graphics cards, all of which will undoubtedly assist both the initial production, viewing and subsequent manipulation of computer graphics files such as that being described and presented with this paper.
3. *Manipulating the image*. It is unlikely that users will wish to alter only some elements of the image, but if colours are to be changed, details amended, additional elements or names added, then the image file must first be 'ungrouped'. Some knowledge of Coreldraw! is then required.
4. *Printing the map*. One of the choices in printing is the nature of the printer; ideally this should be either a colour laser or a colour inkjet, with a minimum resolution of 300 dpi. All or part of the image may be printed, at whatever scale is thought appropriate; the use of standard 1:2500, 1:5000 or 1:10 000 scales facilitates comparison with other published maps. For compactness of transfer, the image file is actually at 1:5000, so the three scales noted imply 200, 100 and 50 per cent plotting, respectively. A much more extensive mapped area at Blakeney means that, even at 1:10 000, four A4 tiled plots are required in hard copy or, at the preferred 1:5000, 16 A4 sheets are involved.
5. *Exporting the image file*. As noted previously, a wide range of raster or bitmap export formats are available within Coreldraw!, but the associated loss in image resolution with all of these will be considerable and the increase in size of image file unacceptably large. CAD or GIS applications may also encounter resolution losses and colour changes, depending on how the file is imported into these environments.

A final point relates to permitted applications of the digital map. Individual academic users are free to utilize and further disseminate the digital map data to other individual users in whatever way they see fit, as suggested in (3) to (5) above. Indeed, this is the whole purpose of making the map available in a digital format. What is, however, specifically prohibited is institutional production of multiple copies of a conventionally printed paper map from this data source.

SUMMARY

It is now possible to produce digital maps with a specialist geomorphological content, such as the Blakeney map, in a simple, non-technical process rather different to that employed by the major mapping organizations, and in a format which makes them accessible to an even wider range of potential users. The ubiquity of PCs and the increasing availability of graphics software packages such as Coreldraw! far outweigh the power and

additional specialist capabilities of dedicated mapping workstations and software. Though the particular application described and offered here is a fairly large map document, the methodology is equally relevant for different kinds of survey, different sizes of area, and including purely morphological maps as well as metric surveys.

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